MESOSCALE VARIABILITY OF THE CALIFORNIA CURRENT

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LONG-TERM GOALS

My long-term goal is to understand the kinematics and dynamics of the California Current System. I am particularly interested in the structure of the inshore flow and the interannual, seasonal, and mesoscale variability that occurs off Central California. I feel that this knowledge can be applied to other Eastern Boundary currents and to naval warfare in these regions.

SCIENTIFIC OBJECTIVES

This project was part of the Eastern Boundary Current ARI. It extended the two-year time series of upper ocean current measurements at 37°-06.7'N, 127°-32.1'W from August 1994 to August 1996. The specific objective of these measurements was to resolve seasonal and mesoscale variability of ocean currents at this location. Since the location coincides with a TOPEX/Poseidon cross over, the temporal variability of observed velocity can be compared to that obtained from observations of the variability of the slope of the ocean's surface.

APPROACH

Our long-term goals are achieved through hydrographic, ADCP, moored current meter and subsurface Lagrangian (RAFOS) float measurements off Central California. The Measurements that we specifically analyzed last year were made by moored current meters that were co-located with an offshore RAFOS source. Instruments (Aanderaa RCM-8 current meters) were located at 50 m, 100 m, 250 m, and 550 m.

WORK COMPLETED

Current meters were recovered on August 27, 1996. They were subsequently re-calibrated and the data processed. Data was provided to other EBC investigators and incorporated into analyses and comparisons of nearshore, slope and offshore currents.

Results of measurements of subsurface flow with RAFOS floats during the period 1992-1995 were submitted for publication (Garfield, et al., 1997). RAFOS floats were launched in February and September 1997.

RESULTS

Current measurements at 50 m extended only to February 1995, when the rotor became fouled by biological growth. At the other three depths, there was a high degree of coherence between the observations. Although the flow was less energetic than that measured during the previous two years, the strongest flow (~ 1 knot) appeared as a pulse of southward flow in January, 1995, and resembled eddies observed at this site in April-May and November 1993. The spectrum of the 4-year record has a distinct peak at 100-days, a somewhat longer period than the 60-day motion which dominated the inshore locations.

RAFOS float measurements at intermediate depths (150-600 m) over the continental margin revealed a region of varying width of subsurface, poleward flow adjacent to the continental margin. The trajectories exhibited three patterns: poleward flow in the Undercurrent, reversing, but predominately alongshore, flow adjacent to the continental margin, and farther offshore, anticyclonic motion accompanied by slow westward drift. Flow continuity of the Undercurrent exists between Pt. Reyes and at least Cape Mendocino with an average speed dependent upon the float depth. Speeds were variable but common features were acceleration occurring to the south of Pt. Arena and deceleration to the north of Cape Mendocino. An important mechanism for floats, and water, to leave the Undercurrent and enter the ocean interior is through the formation of submesoscale coherent vortices. Single particle statistics provide zonal and meridional eddy diffusivity estimates of 1970 and 1830 m^2/s.

TRANSITIONS

We are using our knowledge of ocean currents to help the Naval Oceanographic Office develop databases for Mine Warfare. We also are collaborating with NRL and FNMOC in the development of an ocean model for the California Current System.

RELATED PROJECTS

Related projects involve analysis of shipboard observations of circulation in the Gulf of the Farallones, participation in Central California cruises sponsored by the Naval Oceanographic Office, and, with Mexican colleagues, to understand the flux of heat and salt between the Gulf of California and the Pacific Ocean. The Farallones data were collected on five cruises during 1991-2. Analyses of these data have been completed. The analysis of Ramp et al. (1997) emphasizes interannual variability associated with the 1991-2 El Niño. Steger et al (1997) studied the spatial variability of the tides in the Gulf as well as the circulation observed during each cruise. In February and September 1997, we worked with the Naval Oceanographic Office on hydrographic cruises between Point Sur and Point Reyes. The station pattern for these cruises was based upon the CalCOFI sampling plan

REFERENCES

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